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The Public Finance of Infrastructure

Issues and Options

Vinaya Swaroop

Because it is difficult to raise funds through general taxes, self-financing of publicly provided infrastructure services is a desirable second-best policy — one that almost all developing countries endorse. But the experience of developing countries suggests that, except in telecommunications, full cost recovery is more the exception than the rule. The private provision of infrastructure, an often-suggested alternative, will work only if an appropriate rate of return is assured — and only if user charges cover costs.



Summary findings

Using economic principles, Swaroop provides criteria for financing infrastructure services where consumption-related user charges can be levied effectively.

In light of the suggested criteria, Swaroop examines the experience of developing countries in financing publicly provided infrastructure services in transport (road), water, telecommunications, and power.

In developing countries, most infrastructure is provided by the public sector, although the private sector has become increasingly involved. Because it is difficult to raise funds through general taxes, self-financing of these services remains a desirable second-best policy, one that almost all developing countries endorse.

But experience suggests that, except in telecommunications, full cost recovery is more the exception than the rule. Financing remains inadequate. The political economy of tariff setting is an important element in low and improperly designed user charges, infrequent adjustments for inflation, and poor enforcement.

Such sectors as water, power, and transport drain funds from the treasury, although their impact varies from sector to sector. When it is difficult to get budget transfers to materialize — especially during a fiscal crisis — there is often a reduction in nonwage operations and maintenance expenditures. As a result, services deteriorate.

The private provision of infrastructure services is often suggested as an alternative. The private provision of services can certainly reduce the public sector's financial requirement. For infrastructure services for which technological advances have made competition possible, the market system could ensure efficient private provision of services, which would be a relief to the public sector. But for services that require a single provider to achieve economies of scale and similar benefits, the private provision of services will work only if an appropriate rate of return is assured — and only if user charges cover costs.

This paper — a product of the Public Economics Division, Policy Research Department — is part of a larger effort in the department to analyze methods of financing and pricing infrastructure. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Carlina Jones, room N10-063, extension 37699 (27 pages). April 1994.

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The Public Finance of Infrastructure: Issues and Options

by

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1. Introduction

There is a consensus that private-sector production of goods and services depends crucially upon an adequate, well-maintained and efficient infrastructure of roads, electricity, telecommunications, water, waste disposal and other similar facilities. Electricity and water are essential inputs in the production process, transport and communications are needed to enhance the mobility of goods and services, and sanitary services are needed for waste disposal. Given these intuitively appealing observations¹, what is the rationale for public provision of such services? Has the role of government as provider of these services changed over time with technological developments? How should the publicly provided infrastructure services be financed? These are the main questions this paper addresses. The paper analyzes in brief the role of government as the provider of infrastructure and looks at its provision in a few developing countries (section 2). Using economic principles it provides a criteria for financing infrastructure services where consumption-related user charges can be effectively levied (section 3). In the light of the suggested criteria it examines, by means of a few examples, the experience of developing countries in financing the publicly provided infrastructure services in transport (road), water, telecommunications, and power sectors (section 4). Section 5 presents a few concluding remarks.

2. Public Provision of Infrastructure Services

An important rationale for public provision of (or intervention in) infrastructure activities has been the existence of economies of scale in production. The production and distribution of water,

¹The evidence on the link between infrastructure and economic growth, however, remains sketchy. There is a lack of empirical consensus regarding the magnitude as well as the direction of the effect. The size of infrastructure, the efficiency of provision, and the appropriate public-private balance in its provision appear to be the major issues of contention. See Barro [1991], Easterly and Rebelo [1993], and Devarajan et al. [1993].

for example, may allow for substantial decreases in average cost when the scale of production increases. In telecommunications, transport and power, fixed costs are high as these sectors require a few large investments. Once the systems are set up, output can be increased at declining average costs until the capacity limit becomes binding. It is therefore necessary in such cases to allow a monopolist to engage in the entirety of production. If infrastructure services were provided by an unregulated private monopolist, he would charge monopoly prices to maximize profits. Such monopoly prices associated with profit maximization are not only undesirable due to equity considerations, but they usually lead to efficiency losses when compared with the competitive market outcome. In view of this, a relatively easy monitored producing entity would then be the government itself. In many cases, however, the government is not the producer of the services but it regulates the prices and entry in such industries. Infrastructure services such as electric power, water and gas, telecommunications and transportation are either publicly provided or regulated (if privately produced) and it is typically assumed that the objective of the government as producer or regulator is to maximize social welfare.

Technological advancements over the years, however, have gradually reduced the need for a single supplier of many of these services and have created conditions for competition. For example, in telecommunications, new technologies such as cable-based telephone access, cellular radio, and direct microwave links to local or long-distance switching nodes have reduced the natural monopoly power of the industry. While the provision of local telephone exchange service still justifies a single supplier as unit costs typically fall over a large range as capacity increases, in the interexchange markets the emergence of microwave and satellites have made it possible for several different providers to transmit calls on many routes without significantly reducing unit costs and therefore,

have greatly increased the potential for competition. Similarly, while electricity transmission and distribution continue to justify a single supplier, some form of competition can now be introduced for power generation as development of steam-driven turbines and combined-cycle technologies have reduced the scale economies in electricity generation. Some developing countries are now encouraging the private sector to construct and operate power plants through "Build, Operate and Transfer (BOT)" or "Build, Own and Operate (BOO)" schemes whereby contracts are awarded on a competitive bidding process. Further, to increase choice and competition in transport and water supply, some countries find that efficiency can be enhanced by contracting services for operations and maintenance.

In developing countries while the private sector has been playing an increasing role in recent years, the bulk of the service provision continues to be in the public domain. With a few exceptions, electric power continues to be provided by a single, publicly-owned utility. In the Philippines, for example, while power distribution is largely in the hands of the private sector, the National Power Corporation (NPC) accounts for the bulk of power generation and transmission. The key institutional feature of the telecommunications sector in most developing countries (as is the case of Brazil) is a network operated by a protected state monopolist. Domestic private enterprises provide telecommunications equipment and play the role of contractors in some projects. Water and sewerage services in Indonesia are managed by the local government. Similarly, in Swaziland, the Water and Sewerage Board undertakes all transactions relating to management, operation, maintenance and development of public water supplies and water-borne sewerage facilities. In the road sector, while there are schemes ranging from the use of private contractors to collect bridge tolls (as in Pakistan) to BOT schemes where the private sector agrees to build and operate a toll road (as

in Malaysia and Thailand), the management and provision of roads remains essentially the responsibility of the government.

While it is likely that future technological developments will open up markets for competition and further reduce the public sector's share of infrastructure services, it is important to ensure that any amount of public service provision is efficient. The role of financing is critical in this context.

3. Principles of Public Finance of Infrastructure

How should a publicly provided infrastructure of roads, telecommunications, power, water system and other similar services be financed to ensure the adequate, well-maintained and efficient provision of these services critical for private-sector productivity? Should public enterprises such as power, telecommunications, transport and water be simply required to have full cost recovery?² Alternatively, should there be a flexible approach which incorporates efficiency, fiscal and distributional considerations in assessing the desirable level of cost recovery? What is the role of borrowing in infrastructure finance? Should revenues generated from a sector be linked to its expenditures? These are the issues this section addresses.

Cost Recovery. Given that most of these services are provided at the local level and user charges can be levied on the services, an argument can be made that the cost of service provision should be recovered from the beneficiaries. There is a belief that fairness based on the benefit principle requires consumers of a publicly provided service to pay for it, especially when user charges

²If such a service was to be provided by a regulated private monopolist it is clear that there needs to be at least a zero, if not positive, profit constraint otherwise there would not be a private provision of these services.

can be effectively levied. User charges can be levied in proportion to actual consumption, and where it is difficult to measure individual consumption, a benefit-related betterment levy can be designed to recover the cost of infrastructure development.

Production of infrastructure services is typically characterized by decreasing cost in the long-run which implies that average cost falls as production is increased up to a level often referred to as the minimum efficient scale. Beyond that point, cost per unit is roughly constant. While a financing plan based on short-run marginal cost pricing principle would imply efficient production³, it would most likely be insufficient to cover total costs. For example, in the road sector it is unlikely that the pricing principle based on short-run marginal costs (usually defined as variable road maintenance, traffic congestion and pollution cost) will generate enough revenue to cover total costs⁴. In a study of road sector charges in Tunisia, Heggie and Fon [1990] found that nearly 45 percent of the total costs were fixed. Similarly, telecommunication, power, and water systems periodically require large investments and this often results in marginal cost being lower than average cost for a small scale of output. In such cases user charges based on efficient pricing (i.e., the so-called first-best marginal cost pricing rule) would result in deficits and therefore, budgetary transfers would be required to subsidize the enterprise. Any tax revenue which the government needs to collect, to either make up a deficit resulting from a marginal cost pricing arrangement or for any other purpose, involves some

³The efficient production argument in this context, however, needs qualification. In the absence of a pure profit motive for these public (or regulated private monopoly) enterprises some amount of freedom is introduced in the choice of method of production. The marginal cost pricing argument implicitly assumes that the chosen output combination will be produced at minimum cost. In profit maximizing situations this is true. In regulated enterprises, however, there may be very little incentive for the managers to minimize costs, possibly leading to an inefficient operation. To ensure that infrastructure enterprises produce at minimum cost effective regulatory supervision and internal controls are needed.

⁴There will be a few exceptions, especially in urban areas where roads are extremely congested.

price distortion somewhere in the economy.⁵

In some cases a financing mechanism in the form of two-part tariff can be designed that is based on efficient prices and yet covers total cost. The simplest version of such a tariff scheme involves charging users of the service a constant price per unit purchased equal to the short-run marginal cost and a fixed annual access charge in order to be eligible to buy any positive amount of the service. The total cost of the enterprise is thus recovered by a non-distortionary lump sum access charge on the users of the service, who are then induced to consume in efficient quantities. The pursuit of marginal cost pricing via a two-part tariff, however, is an imperfect solution for two main reasons: First, the allocation of resources that results is economically efficient only if the fixed charge does not cause any potential consumers to drop out of the market and prefer no purchases at all; and second, it is appropriate if distribution considerations are unimportant as the fixed part of the tariff is essentially a regressive head tax. The case of electricity provision in the white municipalities in South Africa, however, illustrates that such a financing principle can be successfully adopted if distributional issues are not of concern. Roodeport, a white municipality located in the Central Witwatersrand Region, purchases electricity in bulk from Eskom, South Africa's national electric utility, and distributes it to its customers. Each year at budget time tariff rates on electricity are determined based on projected expenditures. The structure of the tariff is based on the following charges: (i) A connection charge based on actual cost of connection; (ii) a basic charge designed as a fixed monthly charge to recover capital costs -- both principal repayment as well as interest; and (iii) a per unit consumption charge that is closely related to marginal cost. Since there are no "poor" in Roodeport who cannot afford to pay the regular rates for electricity, there are no equity features

⁵This argument assumes that non-distortionary lump sum taxes are unavailable.

in the tariff design⁶. Electricity provides the largest source of revenue (in gross terms) for the municipality and any surplus generated in the process is used to subsidize other municipal services.

Unlike the case of white municipalities in South Africa, in developing countries the distributional aspect of infrastructure finance is an important policy consideration. A two-part tariff mechanism that is based on efficiency prices and covers total cost is likely to conflict with social objectives. Not only is the fixed part of the tariff regressive and hence, insensitive to the needs of the poor, social concerns require that it may be desirable to apply a "lifeline charge" for services such as water and electricity, which allows a subsidized charge up to a threshold amount (generally considered a minimum) and charges at marginal cost thereafter. While it is important to create a balance between the equity improvements and the efficiency losses, revenue has to be generated in the least distorting way to pay for these subsidies. A financing plan that is based on efficiency prices but makes adjustments in the interest of equity (e.g., provision of lifeline charges) would almost certainly require funds to cover total costs. In this context, therefore, the interesting issue becomes: Should these funds be generated by a mark-up over marginal cost -- a second-best pricing rule -- or through general tax revenues?

If economic efficiency is the criterion then whether or not a sector should be self-financing should be based on the cost (both administrative and efficiency) of raising the marginal unit of revenue from each of these sources. It is estimated that the efficiency cost of a 1 percent increase in all existing tax rates in the early 1980s in the United States would have been between 17 and 56 cents for each dollar of extra revenue raised (Ballard, Shoven, and Whalley [1985]). Experience suggests

⁶However, it is expected that in the new structure of local government in South Africa, equity features would be part of the user charge mechanism.

that revenues from general taxes in developing countries are difficult to come by. Although reliable estimates for developing countries are rare, the efficiency cost of mobilizing extra tax revenue is likely to be higher because tax systems in developing countries relative to industrial countries are poorly designed and implemented (e.g., developing countries have narrower tax bases and weaker tax administrations) thereby encouraging companies and individuals to waste effort on avoiding and evading taxes. Given these facts one could argue that if economic efficiency is the criterion then public enterprises such as highway authorities, electricity, water and telecommunication systems in developing countries should not be subsidized by budgetary sources and be required to cover a major portion, if not full, of their costs through charges on beneficiaries.

Borrowing. Expansion of (or asset replacement in) sectors such as power, telecommunication, irrigation etc. requires periodic large investments. As a result often there are temporary increases in the spending of infrastructure enterprises. Economic theory says that from an efficiency point of view it is better to finance a temporary increase in spending by borrowing (after funds have been exhausted from retained earnings) rather than increasing the charges. Charges over time should be designed to include not only interest payments but also depreciation. Such a financing scheme allows the enterprise to carry a cash surplus over the sum required to meet the debt repayment instalment which in turn can be used to smooth the investment cost when expansion is needed or assets need replacement.

Earmarking. Should earmarking of funds be part of an infrastructure financing policy? For example, if the telecommunications sector is a net contributor to the treasury, should a portion of its

revenue be earmarked for its expansion? Similarly, should a percentage of the municipal government revenue obtained from taxing the ownership and use of motor vehicle (e.g., license fees, fuel and vehicle purchase charges etc.) be earmarked for road sector expenditures? Economic theory tells us that if economic growth is the objective of the government then funds should be allocated in such a way that a unit of public revenue is used to finance the expenditure items which yield the highest economic rates of return. In light of this principle, earmarking is not an efficient expenditure allocation policy. In practice, however, countries do not always allocate expenditure according to this principle even when economic growth is the principal objective. Developing countries often cut, especially during fiscal crisis, expenditures on nonwage operations and maintenance (O&M) which usually have very high rates of return as opposed to a reduction in say, the public sector wage bill. In the Philippines, for example, the overall decline in nonwage O&M expenditures in real terms in early 1980s (since the fiscal adjustment program) is reflected in the poor state of infrastructure maintenance, as shown by deteriorating roads, bridges, ports, and public facilities as well as by the increasing frequency of breakdowns of power plants. Similarly, in Cote d'Ivoire, while the proportion of the budget devoted to the wage bill was substantially higher during the period of 1981-86 than in 1975-80, the share devoted to nonwage O&M fell from 28 to 19 percent [Pradhan and Swaroop, 1993]. This pattern of expenditure restructuring is mainly due to the fact that reduction in the allocations of nonwage O&M expenditures do not have the same political costs as a reduction in the allocation for the public sector wage bill. In such situations, earmarking can help preserve critical expenditures and bridge the gap between economic benefits and political indifference. Thus, while there is no unique prescription for the design of earmarking, as a rule of thumb funds could be earmarked for expenditure items which are usually associated with high economic rates of return.

Experience from developing countries suggests that funds could be earmarked for spending on operations and maintenance in general, and spending on road maintenance and maintenance of irrigation and drainage in particular. The Road Fund in Tanzania is a good example of earmarking funds for road maintenance.

While earmarking provides some assurance of continuous funding, it is by no means a guarantee. In tight fiscal situations, governments divert the earmarked revenues to other uses. For example, since 1973 the Government of Brazil has been earmarking a portion of telecommunications revenue into the National Telecommunications Fund to support the telecommunications expansion program into the less profitable, poorer regions of the country. The telecommunications sector is highly profitable and pays a corporate income tax on its income. Due to the macroeconomic crisis that the country has faced since the late 1970s, part of these earmarked revenues has been diverted to finance other governmental activities. Although this diversion of funds has deprived the sector of valuable resources and has affected its investment program, the action can be justified if the resources are allocated to higher priority activities or to areas where the rate of return is deemed to be higher.

The principles discussed above suggest the following criteria for financing infrastructure services when consumption-related user charges can be effectively levied:

- Before devising a financing plan to recover costs it is important to ensure that infrastructure services are produced efficiently, i.e., the cost of provision should be kept at a minimum. The regulatory system should be designed to effectively counter any supply inefficiencies;
- In general, the design of user charges should be flexible enough to provide a balance of efficiency, distributional equity, and cost recovery objectives. Such a balance of objectives

is likely to vary from sector to sector;

- Optimal revenue generation policy requires that the cost (administrative and efficiency) of raising the marginal unit of revenue through each fiscal instrument be equal. If the financing plan based on efficiency prices with adjustments made for distributional considerations is not likely to cover total costs of the infrastructure enterprises, the cost of raising additional tax revenues should be compared with the cost of increasing prices above marginal cost;
- Developing countries' experience suggests that public enterprises such as highway authorities, electricity, telecommunications and water systems should be required to cover a major portion, if not full, of their costs;
- Full cost recovery in itself is not an indicator of successful financing policy, especially if key expenditure items have been reduced;
- In designing the equity features of the charging system, the intended beneficiaries should be properly targeted;
- Given the nature of investment needs of economic infrastructure, funds could be borrowed at market rates to finance capital expenditures; user charges should be designed to include depreciation and interest payments;
- Whether infrastructure enterprises should be subject to income taxes and whether services such as telecommunications and electricity should be included in a broad based tax on goods and services such as a value added tax are issues which are somewhat difficult to generalize. Such propositions require a careful examination of each country's tax system and therefore, should be decided as part of the tax reform process of that country;
- Earmarking of funds should be restricted to expenditure items which are generally associated

with high rates of return but are politically less visible and are likely to be cut during periods of fiscal austerity.

4. Financing Infrastructure Services in Developing Countries: Some Examples

In most developing countries public enterprises such as highway authorities, electricity, water and telecommunication systems are expected to operate commercially without the need for financial support from the government. In practice, except for telecommunication services, this is generally the exception rather than the rule. Low and improperly designed user charges, infrequent inflation adjustments and poor enforcement often lead to major revenue shortfalls. The resultant budgetary transfers worsen the general fiscal deficit of the government.

Transport (Road Subsector). In many Sub-Saharan African countries the public enterprise deficits are often the primary source of general fiscal budget deficits. In Zambia, for example, the budgetary transfers to the transport sector in the fiscal year 1991 exceeded K 5 billion (nearly \$ 100 million) which was roughly equivalent to 12 percent of the government's total current revenues. This financial drain was largely due to three public sector agencies: roads, railways and the airline. In the road sub-sector one of the main reasons for the shortage of finance was that road users were paying negligible sums for the use of the road network. License fees had not kept up with inflation and were low by regional standards, and fuel was only subject to a standard excise designed as a general tax with no explicit user fee added to the price. The specific road user charges - mainly license fees, transit fees paid by foreign vehicles and road tolls - were only financing 10 percent of the total expenditures on roads. In fact, the road sub-sector budget has been in deficit during the entire 1980s.

The transport sector in Tanzania is plagued with similar problems. In 1986/87 its overall balance showed a deficit of T Sh 2,405 million (over \$ 46 million), or roughly 7.3 percent of government current revenues. In both these countries, the transport sector would have required even more transfers from the government if the allocations for road maintenance were not woefully low.

In Indonesia, the total revenues accruing to government from road users -- mainly from indirect taxes on vehicles, parts and fuel, and from provincial government fees for vehicle registration and ownership transfer -- have been in line with the level of spending on the public road network in recent years. However, it is unclear whether all the indirect taxes levied were designed to recover the costs of road usage. Some of these taxes (e.g. value added tax, import duties, luxury import tax etc.) are levied to generate general fiscal revenue to support the government's overall expenditure plans or as part of its trade and industrial policies. Unless the two functions are clearly separated, it is unclear as to what part of the taxes can be referred to as the price of road use. Charges related to vehicle usage -- for example, charges added to the fuel tax, tolls and weight distance charges -- and vehicle ownership -- for example, vehicle licenses, registration fees, vehicle inspection fees and vehicle transfer tax -- could be broadly defined as road-specific user charges.

In Indonesia, the current structure of annual vehicle registration tax (PKB) is based on type and age of vehicle and its engine capacity which do not reflect the road damaging power of vehicles; in particular, the level of PKB is too low for trucks. The vehicle ownership transfer tax (BBN-KB) is applied at a rate of 10 percent for new vehicle sales and 5 percent for subsequent ownership transfers. Clearly, these provisions prevent efficient use of roads by sending wrong signals to commercial vehicle owners who in turn make sub-optimal decisions that increase cost to society.

Recovering full cost and contributing to general revenues *per se* is not an indicator of

successful financing policy for the sector. This is especially true if key expenditure items have been reduced. For example, a major reason for the deterioration of road infrastructure in the Philippines has been the decline in road expenditures in real terms, especially for maintenance, during the 1980s. Revenue raised from user charges, however, have more than offset road expenditures during this period and as a matter of fact, the road sector has been consistently making significant net contributions to the general budget.

In a study of developing countries Heggie (1991) found that road user charges were significantly less than total expenditures on roads and in some cases were even less than recurrent expenditures on roads (see Table 1). Of the sampled countries, only in China and Turkey have user charges exceeded expenditures on roads.

Table 1
Road User Taxes/Charges
(Local currencies at current prices)

	Overall Government Tax Revenue	Revenue from Road Sector				
Country		Total Taxes {A}	General Taxes (% of {A})	Road User Charges (% of {A})	Total Road Spending [Recurrent]	Ratio of Charges to Spending (percent)
Argentina 1987 (Austral, millions)	29,584	2,922 ^a	81	19	1,209 ^a [..]	47 [..]
Bangladesh 1984/85 (Taka, millions)	32,900	1,600	75	25	2,088 [416]	19 [96]
Bolivia 1987 (Bolivianos, millions)	613	177	79	21	141 [23]	26 [161]
China 1986 (Yuan, billions)	244	11	0	100	9 [2]	119 [470]
Mexico 1988 (Pesos, billions)	69,214	7,158 ^a	39	5	831 ^a [307]	42 [113]
Tanzania 1985/86 (Shilling, millions)	19,776	2,016	88	12	1,267 [672]	19 [35]
Turkey 1983 (Lira, billions)	1,938	268	13	94	115 [43]	217 [584]

Notes: (i) ^a Central government only; ^b Central, provincial and local government; .. indicates not available.

(ii) Road user charges have been separated from the total revenue from the road sector by crediting the user charge element with any taxes which were higher than similar groups of items in the tax structure: fuel taxes were ignored unless fuel prices were higher than border prices.

Source: Based on Heggie (1991).

Water.

(a) Irrigation. In many developing countries irrigation charges are so low and the attempts

to collect them so feeble that cost recovery has fallen far short of even modest targets such as recovery of maintenance expenditures. Charges do not reflect the cost of production, consumption increases beyond the optimum level and the subsidies disproportionately serve the better-off. While total cost recovery for any irrigation district of any size is virtually without precedent, it is becoming hard to find cases where irrigation charges even recover operating and maintenance expenses. For example, in India irrigation charges recover roughly 8 percent of O&M costs; in Bangladesh, O&M recovery through irrigation charges is in the range of 10 to 15 percent; in Pakistan between 40 and 50 percent; and in Mexico and in the Philippines it is nearly 80 percent. Consequently, public irrigation schemes have become an enormous drain on government budgets and have deprived other sectors of the economy -- where user charges are infeasible -- of budgetary resources.⁷ Evidence indicates that these subsidies do not even serve the purpose of distributional equity as they go predominantly to better-off farmers [Repetto, 1986]. This pattern of financing has created a vicious cycle: Due to serious financial difficulties, irrigation departments often defer maintenance (or allocate insufficient funds for maintenance) resulting in the deterioration of the water system; farmers complain of the poor services rendered and have few incentives to pay for it. This is despite the fact that most irrigation departments in developing countries have the mandate to recover operations and maintenance and at least some part of the capital cost. Take the example of India where the National Water Policy of 1987 clearly stipulates that charges on water should be designed to cover the annual operation and maintenance charges and a part of the fixed costs. Yet, revenues from irrigation

⁷ An oft-suggested argument is to include irrigation sector-based revenues (such as direct taxation of irrigated farmers) stemming from non-water charge sources in examining the financial sustainability of irrigation schemes. Such taxes, however, are designed as part of the general revenue taxes to be used for government services which are mainly public goods in nature.

charges were enough to recover only 7.5 percent of O&M expenditures in 1988-89 (down from 22 percent in 1980-81). During the 1980s, revenues from water charges increased by 29 percent in real terms; by contrast, O&M expenditures increased by 280 percent during the same period. While there are a number of supply inefficiencies in the service provision,⁸ the slow growth of revenues from water charges has been due to (a) infrequent revision in the rates resulting in substantial erosion over time in real values; and (b) poor collection rates. Water charges have not been changed since the mid-1980s in most states and not since the mid-1970s in the states of Punjab, Haryana, Tamil Nadu, and West Bengal. The low rates and poor collection are mainly due to politicians who continue to favor subsidies due to intense lobbying by the farmers. Attempts to revise water rates are often killed and amnesty for non-payment of charges are frequent. Studies in the Indian context have shown that even if irrigation charges are raised to cover O&M and at least 25 percent of capital costs, the value of water delivered to farmers would still far exceed what they must pay to get it.

Irrigation agencies in Pakistan suffer from a similar fate. In the not too distant past, part of the capital costs of irrigation development were recovered from users in Pakistan; revenue receipts were higher than total O&M expenditure by 13 and 25 percent in 1972-73 and 1973-74 respectively. In recent years, however, cost recovery has lapsed mainly due to inadequate increases in water charges. The cost recovery was 56 percent in the fiscal year 1992 and falls to 43 percent if actual O&M expenditures are replaced by the more realistic O&M requirements. The irrigation and drainage systems are now in dire straits due to lack of maintenance funds. Current water charges are only 5

⁸The steep rise in O&M expenditures was primarily due to growth in irrigation department wage bills, mostly due to burgeoning staff. In the state of Bihar establishment (personnel) costs increased by 148 percent in only four years (1980-81 to 1984-85) while expenditures on maintenance of water systems declined slightly. This pattern of expenditure does not seem to produce the services in an efficient way.

percent of farm income. It has been estimated that to obtain full recovery of current O&M charges, the water rates need to be doubled which would amount to less than 10 percent of farm income.

In Indonesia, irrigation water supply -- a key agriculture support service provided to farmers -- has been a major drain on public resources in Indonesia. The estimated total subsidy for irrigation water during the country's fourth five-year plan (REPELITA IV, 1984/85 - 1988/89) was Rp. 4.8 trillion, an amount that even exceeded the subsidy for fertilizer, the other important agricultural input provided by the government. Until recently, there was an indirect cost-recovery mechanism in the form of a small land tax and the farmers were not required to pay directly for irrigation facilities. Realizing this concern, the government has instituted an irrigation service fee related to cropping patterns/systems on a pilot basis in a few provinces to improve O&M. The starting level of the irrigation service fees is at least 50% of the estimated O&M requirements. As part of the reform process, farmers are also being asked to provide labor services and pay water association user fees.

There is some evidence that cost recovery is higher with institutional arrangements wherein users have a high degree of control over irrigation distribution systems. In such arrangements since farmers can control water distribution the risk of supply shortages at critical growing periods is reduced and therefore their willingness to pay for water increases. In the Philippines, for example, farmers participate in communal programs by operating the irrigation distribution facilities. As part of the Irrigation Associations they are also responsible for maintaining the water systems and collection of the irrigation service fee. Cost recovery as a percentage of O&M expenditures has averaged 80 percent in the 1979-89 period. Similarly in Mexico, decentralization and reduction of the role of government by transferring the O&M functions to user organizations have been the key issues in the sectoral reform program. As a result of this reform process, water fees collection as a

percent of O&M expenditures has increased from about 18 at the end of 1988 to nearly 83 by late 1993. The government's target is to achieve total cost recovery of O&M expenditures by 1995. Relatively high cost recovery rates for both O&M and capital costs are found in the United States, particularly in the districts where local irrigation associations own and operate water distributional facilities.

(b) Water for non-agricultural use.

Water and Sewerage services in Urban Swaziland. The Water and Sewerage Board provides treated water to over 80 percent of the urban population and manages four major sewerage schemes which serve 25 percent of the urban population. While the Board is expected to operate on a commercial and self-financing base, in practice this has not been the case. The Board has been experiencing financial difficulties since mid 1985 and has been relying on the government to provide budgetary transfers. Inadequate tariff adjustment, poor collection, and unaccounted for water are the main reasons for the poor financial performance of the Board. Estimates suggest that if the Board (a) improves its billing and collection procedures, (b) gets an adequate tariff increase, and (c) takes appropriate steps to reduce the level of unaccounted for water, it would not only recover its operating expenses but would be able to contribute a significant portion of capital expenditure.

Urban Water Supply in Nigeria. Water supply in the urban areas of Nigeria provides an example of a system where almost everything is broken: Access to safe water supply is limited to 50 percent of the urban population (an even smaller segment of the population has access to sanitation facilities); water supply is inefficient (unaccounted-for water is reported to be as much as 50 percent of the total

output in some areas) and cost of service is high; due to low levels of water tariffs most water authorities are dependent on federal and state subventions for part of their operating costs and practically all debt service charges; and given the government's own budgetary constraints, transfers have been limited resulting in deferred maintenance, few new investments and increasing indebtedness of the water authorities. In such cases partial reforms would not suffice. For example, a rate increase in water tariffs alone would be met with strong opposition from consumers (as has been the recent experience). What is needed in such cases is a complete restructuring of the system along the fundamentals of water provision and financing. The objectives of the reform process should include enhanced autonomy to water agencies for staffing and salaries, and for periodic tariff adjustment (with appropriate regulatory supervision). Water agencies should be allowed to devise a tariff system which allows them to recover their operating costs, depreciation charges and interest payments, and enables them to partially self-finance future capital equipment; in turn, they should be accountable for better service provision. In addition, the option of private sector management of water agencies should also be explored.

Private Sector Management of Water Enterprises in Cote d'Ivoire. The case of urban water supply in Cote d'Ivoire provides an example of an efficiently run infrastructure service. Sodeci, a private company, has been the supplier of piped water in the urban areas for the last 30 years. Operating the state-owned water supply systems within the framework of a lease contract, the company has achieved full cost recovery (user charges cover capital costs and O&M) for many years. It has been paying taxes to the government since its inception and has paid dividends to its shareholders. The water connection ratio in 1992 was 70 percent and increasing; unaccounted for water has been lower

than 15 percent in the last 15 years; and the level of service is close to western standards. The efficiency of service provision is illustrated by the fact that its average water tariff is not higher than the ones in the neighboring comparator countries where the level of service is much lower and full cost recovery is not achieved.

Telecommunications. Among the publicly-provided infrastructure services in developing countries, telecommunications is the only sector that is profitable and a net contributor to the treasury. In telecommunication sector the average ratio of revenue to cost for a sample of 100 developing countries was 1.6 in 1992. Unlike electricity and water services, residential telephone service is essentially a luxury good in developing countries, which means that there is no reason to have lifeline rates or similar subsidy schemes. With little justification for political intervention, tariff rates are often set at a level which allows not only full cost recovery but a significant contribution towards general fiscal revenue. The fact that telecommunications is a highly profitable sector in developing countries does not necessarily assure that the service provision is efficient and customers get the quality they pay for. For example, despite being a highly profitable sector and a net contributor to the public treasury, the performance of the Indonesian telecommunications sector, in particular the telephone network, has been below par. Indonesia's telephone density of roughly half-a-percent is the lowest among the ASEAN countries and the network remains inadequate with significant unmet telephone demand, congestion, high rates of call failure and fault incidence. While the tariff policy of TELEKOM, the state telecommunications agency, is rightly geared to efficient demand management and supporting more rapid network development, supply efficiency needs improvement. Raising productivity and reducing production costs would be important not only to

improve efficiency but also to upgrade the financial performance to enable it to raise its own contribution to an expanded investment program. Appropriate tariff policy has allowed TELEKOM to achieve full cost recovery and also self-finance a sizable part of its investment program. During REPELITA IV, the state telecommunications agency implemented an investment program of Rupiah 1.44 trillion (or, nearly \$ 1 billion), which was financed through 22 percent of its own retained earnings, 67 percent foreign borrowing, and 11 percent domestic bank borrowing. At the same time, TELEKOM has been making a notable net contribution to the public treasury through income tax payments (it is subject to a 35 percent corporate income tax) and dividends on government equity. Further, 55 percent of its net of tax income goes to the Government of Indonesia Development Fund which is used to finance other governmental activities.

A similar story emerges from Brazil where despite problems in the quality of service (relative to its comparator countries) and structural inefficiencies in the tariff system, TELEBRAS, the national telecommunications company, has been one of the strongest of all Brazilian state-owned companies, second only to PETROBRAS, the national oil company, in size and profitability. Its substantial expansion in the late 1970s was largely financed from its own funds and it has been a net contributor to the treasury. Despite the high profitability, actions are needed to improve the service provision. Among the high policy priorities is the need to rebalance the structure of tariffs, partly to improve service quality, and partly to generate funds for capital investment.

Electric Power. The power sector is heavily capital intensive and in most developing countries its resource requirements are by far the largest. How a lack of appropriate new investment and an inefficient utilization of the existing facilities in the power sector can have a ripple effect on the

economy in terms of low productivity, lost sales and income erosion is illustrated by the experience of the Philippines. The National Power Corporation (NPC) is responsible for power generation and transmission in the Philippines and has been the biggest user of funds under the public investment program. However, no new power plants were completed between 1986-92 despite an approximate 10 percent per annum increase in demand. NPC has also paid inadequate attention to operations and maintenance of its existing facilities which has resulted in reduced plant availability and premature plant aging. As a result severe power shortages and increasingly frequent brownouts are exacting a toll on the country's commercial and industrial activities. While fiscal constraints have limited the government's capacity to make new investments in the sector, insufficient levels and inadequate structuring of tariffs have been the major contributing factors for NPC's lack of spending on operations and maintenance on the existing facilities. In recent years, the financial situation of NPC has been poor; it has not been able to generate enough cash for financing its investments. A well-managed power utility generally recovers all its O&M expenses, depreciation and interest charges, and is also able to self-finance a significant portion (normally 20 to 30 percent) of its capital expenditures. The self-financing ratio for NPC was negative during the period 1987-90, 1 percent for 1990, negative 54 percent for 1991 and 7 percent for 1992. Recently, the government has approved a new set of tariffs that has improved the financial viability of NPC.

Financial performance of a utility could be misleading if financial cost understates economic cost. For example, until recently, PLN (Perum Listrik Negara) -- a single publicly-owned electric utility in Indonesia -- was able to generate enough revenue to meet its operating costs and finance part of its investment program. One reason why PLN was able to achieve its financial targets was the substantial below-market financing it was getting from the government for all of its borrowing.

Further, PLN was getting large production facilities as equity to promote regionally balanced development (basically, a social objective) without having to pay any dividends to the government. These provisions understated the true cost of capital. While PLN's borrowing has been at market rates for the last three years, there is still little transparency in the manner in which the subsidies designed to promote regional development flow. What is needed is compensation on a transparent basis for any losses incurred by PLN for meeting government's social objectives.

Many a times the sector's investment requirements are so high that the resources needed exceed the aggregate of the sector's capacity to generate cash from its operations and the government's capacity to finance from budgetary allocations. To cope with such situations, long term debt instruments bearing terms that are appropriate for the long construction and payback periods normally associated with power sector investments, are needed.

5. Conclusion

In developing countries the bulk of infrastructure provision continues to be in the public domain though the private sector share has risen in recent years. In view of the difficulty in raising funds through general taxes, self-financing of these services remains a desirable second-best policy and almost all developing countries endorse it. Experience, however, suggests that barring the telecommunications sector, full cost recovery is more of an exception than a rule. Financing remains inadequate with the political economy of tariff setting being an important contributing factor to low and improperly designed user charges, infrequent inflation adjustments and poor enforcement. Sectors such as water, power and transport continue to drain funds from the treasury though the impact varies from sector to sector. When budgetary transfers are difficult to materialize, especially

during a fiscal crisis, this often leads to a reduction in nonwage O&M expenditures which in turn results in deterioration of services.

Private provision of infrastructure services is often suggested as a solution to the aforementioned problems. Private provision can certainly reduce the financing requirement for the public sector. For infrastructure services where competition is becoming possible due to technological advancements, the market system could ensure efficient provision and relieve the public sector from being the provider of such services. However, for services that continue to require a single provider due to scale economies or other reasons, private provision would not result as long as an appropriate rate of return is not assured. User charges that reflect cost would be required for private provision.

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